# FUTURE STRATEGIC ENVIRONMENT

- Introduction
- Political
- Economic
- Technological
- Military
- Space
- Foreign Threat
- Implications

## INTRODUCTION

In 2020, prior to hostilities or during peace operations, an adversary will have sophisticated regional situational awareness. Enemies may very well know, in near real time, the disposition of all forces. They will command and control their forces with real-time access to precise navigation (position and timing), submeter imagery, highly accurate weather data, timely missile warning, and robust communications.

Space will enable these capabilities. In fact, national military forces, paramilitary units, terrorists, and any other potential adversaries will share the high ground of space with the United States and its allies. Adversaries may also share the same commercial satellite services for communications, imagery, and navigation. Gaining superiority in space will be challenging. The space "playing field" is leveling rapidly, so US forces will be increasingly vulnerable. Additionally, though adversaries will benefit greatly from space, losing the use of space may be more devastating to the United States. It would be intolerable for US forces, modeled along the lines of a Joint Vision 2010 force, to be deprived of capabilities in space.

To further explore the anticipated 2020 environment, we have compiled some key political, economic, technological, military, and space trends and assertions. The first four are consistent with those used in *Joint Vision 2010,* the Joint Strategy Review, and the National Defense Panel. Following the trends and assertions, we'll discuss their implications for US space power.

## POLITICAL

> "Our space policy objectives include deterring threats to our interests in space and defeating hostile efforts against US space assets if deterrence fails..."
>
> *A National Security Strategy for a New Century, May 1997*

- The United States will remain a global power and exert global leadership.
- It is unlikely that the United States will face a global military peer competitor through 2020.
- The main causes of warfare will be nationalism, ethnic separatism, religious extremism, and scarce resources.
- Nation-states will continue to fragment, sparking regional unrest.
- Non-state actors (e.g., drug cartels, crime syndicates, terrorist organizations, as well as non-governmental organizations and multinational corporations) will become more important.
- Temporary alliances will emerge as expedient ways to address various political situations.
- The United States won't always be able to forward base its forces.
- Widespread communications will highlight disparities in resources and quality of life–contributing to unrest in developing countries.

# ECONOMIC

"We need to turn to space as an essential program to support our economic competitiveness and to help our assessment of ways to reverse the negative trends in the environment. We should adopt an international space cooperation strategy.... It would encourage closer bonds between nations, reduce cost and development time."

*Edward C. "Pete" Aldridge, President and CEO, Aerospace Corporation*

- The global economy is relying more on information and information processing.
- Other nations, and possibly multi-national corporations, will challenge the United States.
- The global economy will continue to become more interdependent. Economic alliances, as well as the growth and influence of multinational corporations, will blur security agreements.
- The gap between "have" and "have not" nations will widen–creating regional unrest.

# TECHNOLOGICAL

"Advanced technologies can make third-class powers into first-class threats."

*Dick Cheney, Former Secretary of Defense*

- Rapid advancement of technology will create revolutionary breakthroughs. Commercial interests will drive most technology development, especially within space and information processing.
- Information connectivity will grow rapidly.
- Nations and non-state actors with enough resources will immediately gain access to new systems and technologies.
- More nations will access space and information technologies and products. Rapid integration of information enabled by space capabilities, will be the key to successful operations.
- High-speed, high-volume telecommunications technology, coupled with advances in computers, will enable vast, interactive, information databases on globally networked computers.
- Advanced warheads and stealth technology will become more common in ballistic missiles.

# MILITARY

"Space is already inextricably linked to military operations on land, sea, and in the air."

*Joint Strategy Review, January 1997*

- The United States remains the only nation able to project power globally.
- The precision and lethality of future weapons will lead to increased massing of effects rather than massing of forces.
- Technology will proliferate for weapons of mass destruction (and delivery systems).
- Asymmetrical attacks will be a growing concern.
- Rapid and dynamic US military operations will increasingly depend on an information-networked environment.
- Precision operations will depend more on non-lethal options.
- Forward presence will continue to be important to shaping and preparing a region, but sovereignty issues may impede it.
- Coalitions will continue to be important to future US military operations, but the United States will keep the ability to act unilaterally if required.

# SPACE

"I think that space, in and of itself, is going to be very quickly recognized as a fourth dimension of warfare."

*General Ronald R. Fogleman, USAF, Ret*

- Space has been "militarized" for 40 years. Reconnaissance, surveillance, warning, communications, weather, and most recently, navigation satellites were designed and deployed to serve national security needs. Systems related to national security have dominated space, but this dominance is eroding rapidly. The increasing number of countries and consortia turning to space to provide and receive services–and to generate wealth–will force nations to adapt to this emerging environment.
- Space capabilities are proliferating around the world.
- Space commerce is increasingly integral to the global economy.
- Military and commercial uses of space will become vital national interests for the United States.
- Achieving space superiority during conflicts will be critical to the US success on the battlefield.
- Traditional military missions for land, sea, and air are migrating to space (e.g., communications and surveillance).
- Military, civil, and commercial space sectors are converging.
- The shift will continue from the military to the commercial sector as the dominant receiver and provider of space services.
  - In 1996, for the first time, commercial launches exceeded military launches in the United States.
  - Commercial space revenues outstripped government space expenditures in 1996.
  - The United States has $100 billion invested in space today. Between now and 2000, another $500 billion will be invested worldwide.
  - Today, more than 1,100 commercial companies across 53 countries are developing, manufacturing, and operating space systems.
- Military resources will shift from sustaining systems, and research and development to buy-and-lease services that are always state of the art. This shift means we'll have to make sure the accompanying vulnerability doesn't threaten our national security.
- One of the long acknowledged and commonly understood advantages of space-based platforms is no restriction or country clearances to overfly a nation from space. We expect this advantage to endure.
- Sovereignty will remain a concern. The exploding number of satellites will bring competition for orbit parking locations, frequency allocation, and "basing rights" to distribute uplinks and downlinks to/from ground stations. We may reasonably compare the impending rush to space to a gold rush, with insufficient universally accepted "rules of the road" to make this rush orderly and without incident. We must develop appropriate responses if others interfere with US satellites.
- Space capabilities will be increasingly important to society.

# FOREIGN THREAT

Space-based systems and products will increase our enemies' potency and level the military playing field. The explosive commercial development of space capabilities will make space products accessible to any organization with resources. The blending of military and civilian systems complicates our ability to distinguish when an enemy is gaining advantage from space systems. Amplifying the potential threat is the compression of time from "intent to use" because future space systems will operate in near real time.

Technological advances also provide unparalleled capability and access to potential adversaries. For example, higher bandwidths, better imagery resolution (less than 1 meter), and the sheer number of payloads in space will act as combat multipliers. An adversary's ability to command and control forces will gain much from dynamic, global, communication networks such as Iridium, Globalstar, and Teledesic. Anyone with Internet access will get highly accurate imagery almost instantly. Satellites for navigation are proliferating and adversaries will use them to enable precise military operations.

Advanced technology will help develop counterspace weapons aimed against US space systems (satellites, links, and ground stations). Improved sensors supported by supercomputers will produce superior space systems that depend less

on ground infrastructures for tracking, telemetry, and satellite control, making them more useful in military operations. But directed-energy weapons can permanently or temporarily disable these critical satellite functions and will probably be the preferred antisatellite technology for wealthy states.[1] Lesser powers and other actors may prefer jamming, information operations, and other techniques.[2] The enemy's hostile capabilities may include kinetic, electronic, and directed-energy systems to negate US satellites. An enemy may also use deception and information operations against our command, control, communications, computers, and intelligence (C4I). Listed below are some potential threats to US space systems and operations.

## Electronic Warfare (EW) and Laser Attacks

Vulnerability of satellite systems to jamming and component damage of various sorts depend strongly on particular designs. Low-earth orbiting satellites can be accurately tracked, allowing an adversary to concentrate large amounts of energy on them. Since imaging optical systems must concentrate incident light on a small sensitive detector, laser attacks against these sensors can be highly effective.

## Direct Ascent

Enemy nations that can track satellites and fire significant payloads into space can place important satellites at risk using inexpensive direct-ascent weapons. But this ability will belong only to the most advanced countries.

## Passive Measures

The accuracy of publicly available software to predict satellite orbits will mean some actors can use satellite warning as part of a plan for concealment and deception. DESERT STORM revealed the extent to which the US military relies on satellite reconnaissance for military support. Effective concealment and deception will deny friendly observation of major weapons and troop activities.

## High-Altitude Nuclear Detonations

A high-altitude nuclear detonation would create electromagnetic interference against satellite communications. Only a few nations will be able to do so, but they will also rely on space-based services and products that would be vulnerable to the same effects. Nation states probably wouldn't be willing to accept fratricide of satellite systems.

## Information Operations

Tools of warfare in the Information Age may not be the same as in the past. Offensive information operations are attractive to many nations because they are cheap relative to the cost of developing, maintaining, and using advanced military systems. In fact, information operations tools may be readily accessible to third world nations or non-state actors. Information attacks will consist of creating false information, manipulating information, and inserting malicious, logic-based weapons in the space-based, globally shared infrastructures for telecommunications and computing. Much of the information on how to exploit design attributes and security flaws of commercial computers will be freely available on the Internet.

Future potential adversaries will challenge the US ability to maintain a comparative advantage. Increasing access to space capabilities will contribute greatly to the leveling of the playing field between the United States and its enemies. Enemy battlefield situational awareness will challenge the United States on a regional level at a minimum, enabling the adversary to execute offensive and defensive operations with unprecedented speed and accuracy. There is a distinct overlap between information operations and the Control of Space operational concept.

# IMPLICATIONS

Space capabilities are becoming absolutely essential for military operations, national commerce, and everyday life. In fact, space is emerging as a military and economic center of gravity for

our information-dependent forces, businesses, and society. Life on earth is becoming inextricably linked to space.

Traditional military, civil, and commercial capabilities in space are rapidly converging. In navigation, they've already converged. The Global Positioning System (GPS), originally developed to support US military forces, is now essential to the US Department of Transportation's management of air, land, and maritime transportation. GPS products are predicted to generate $8 billion in commercial revenue by 2000.

The military is passing management of national weather satellites to the National Oceanic and Atmospheric Administration. Cable television stations now routinely market satellite weather information (e.g., The Weather Channel).

Commercial markets will expand for imagery, such as that provided by LANDSAT/EOSAT or SPOT, and routinely, multispectral and hyperspectral products.

Communications may be the most significant example of convergence. Within ten years, civil, commercial, and military interests will invest nearly $500 billion to place more than 1,000 new satellites into service, most of them related to communications. That's more than twice the current inventory of active satellites. These launches may be more than the United States can support from two spaceports and will even challenge international competitors. Also, identifying and cataloging the associated debris in orbit will be no small task and will be critical to the safety of human spaceflight and satellites in near earth orbit.

Technological advances in computing and networking will make the Internet mushroom, making even more data available. Changes in telecommunications will result in an equally explosive growth of the information infrastructure around the world. Technological advancements will dictate reengineering of all radio-frequency communications, resulting in tetherless, mobile, and wireless access from anywhere on the globe. These advances present complex situations that will make attaining a military advantage more difficult. This information revolution will help establish a "global electronic village" that shares ideas and images in real time.

These converging sectors will improve the quality of life for hundreds of millions of people around the world. Mobile communications; agricultural benefits; entertainment; precise navigation in automobiles, boats, and aircraft; storm warning; banking; and personal computing will depend on leading-edge commercial space services. People will demand reliability and won't tolerate interrupted service. We may not be too alarmed today if sports scores aren't passed to our beepers, but we'll be more concerned tomorrow if our paychecks don't get into our bank accounts. Disruption of space service will widely affect individual citizens.

Freedom of operations within the region of space is critical to our nation's future. Given the huge economic and military importance of space, USSPACECOM must shape the region of space and be prepared to protect and defend the US national interests and investments in space. Over time, USSPACECOM must:

- Integrate space forces and information throughout the force structure.
- Develop and maintain the ability to achieve space superiority when required.
- Support and enhance worldwide missile defense and develop ways of using space to hold terrestrial targets at risk.
- Identify core military capabilities in space and ways to partner with civil and commercial space organizations or other nations to augment these capabilities.

[1] Allen Thompson, "Satellite Vulnerability: A Post-Cold War Issue?," Space Policy (ISSN 0265-9646), 11(1), Feb 1995

[2] Ibid